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Applicant(s): HABLEY MEDICAL TECHNOLOGY CORP (US) ;
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ABSTRACT:

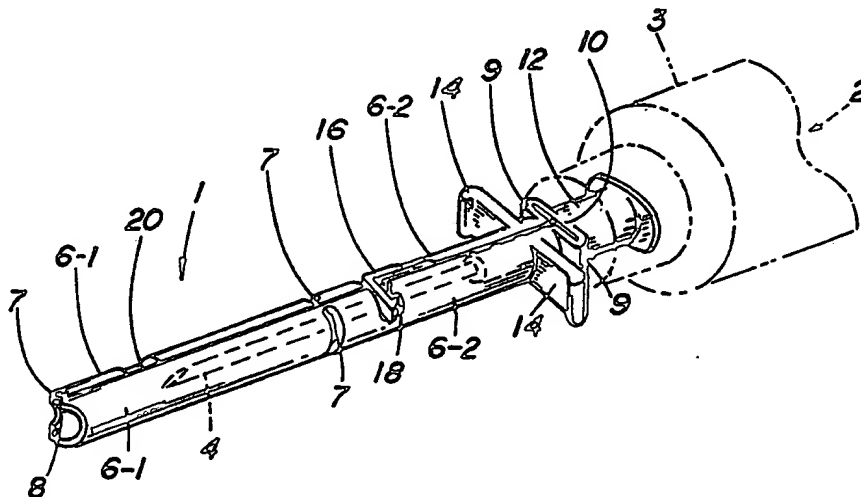
A safety enhancing, relatively low-cost, needle cover (1) which is integrally bonded to a disposable needle cannula (4) of a hypodermic syringe (2) and adapted to eliminate the handling and/or destruction of the needle after use. The needle cover comprises distally and proximally oriented pairs of needle cover segments (6-1, 6-2) which are hingedly interconnected and pivotable relative to one another. The needle cover is collapsible from an open, expanded configuration, with the cannula biased in an armed state for administering an injection of the fluid contents of the syringe, to a closed, generally planar configuration, with the cannula biased in a shielded state completely surrounded, shielded and isolated after use. By virtue of the present invention, the needle cannula can be safely discarded within its collapsible cover while avoiding an accidental needle strike and the spread of a contagious, and possibly life threatening disease.



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<p>(21) International Application Number: PCT/US89/00739</p> <p>(22) International Filing Date: 23 February 1989 (23.02.89)</p> <p>(31) Priority Application Number: 159,373</p> <p>(32) Priority Date: 23 February 1988 (23.02.88)</p> <p>(33) Priority Country: US</p> <p>(71) Applicant: HABLEY MEDICAL TECHNOLOGY CORPORATION [US/US]; 22982 Alcalde, Laguna Hills, CA 92653 (US).</p> <p>(72) Inventors: HABER, Terry, M. ; 24011 Castlewood, Lake Forest, CA 92630 (US). LEWIS, John, A. ; 550 Paularino, #G102, Costa Mesa, CA 92626 (US).</p> <p>(74) Agent: FISCHER, Morland, C.; 4650 Von Karman Avenue, Newport Beach, CA 92660 (US).</p>	<p>(81) Designated States: AT (European patent), BE (European patent), CH (European patent), DE (European patent), FR (European patent), GB (European patent), IT (European patent), JP, LU (European patent), NL (European patent), SE (European patent).</p> <p>Published With international search report.</p>	

(54) Title: COLLAPSIBLE NEEDLE COVER



(57) Abstract

A safety enhancing, relatively low-cost, needle cover (1) which is integrally bonded to a disposable needle cannula (4) of a hypodermic syringe (2) and adapted to eliminate the handling and/or destruction of the needle after use. The needle cover comprises distally and proximally oriented pairs of needle cover segments (6-1, 6-2) which are hingedly interconnected and pivotable relative to one another. The needle cover is collapsible from an open, expanded configuration, with the cannula biased in an armed state for administering an injection of the fluid contents of the syringe, to a closed, generally planar configuration, with the cannula biased in a shielded state completely surrounded, shielded and isolated after use. By virtue of the present invention, the needle cannula can be safely discarded within its collapsible cover while avoiding an accidental needle strike and the spread of a contagious, and possibly life threatening disease.

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COLLAPSIBLE NEEDLE COVER

TECHNICAL FIELD

This invention relates to a safety enhancing and relatively low-cost needle cover which is integrally connected to a disposable needle cannula of a hypodermic syringe, wherein the cover is collapsible from an open, expanded configuration, at which the cannula is exposed for administering an injection, to a closed, generally planar configuration, at which the cannula is completely surrounded, shielded, and isolated after use.

BACKGROUND ART

Hypodermic syringes are used for a variety of purposes. By way of example, the syringe may be used to expulse fluid medication to a patient by way of a hypodermic needle cannula. However, the syringe may be used to treat a patient with a communicable disease. Prior to disposal of the syringe, the needle cannula thereof is sometimes broken to prevent reuse. Health care workers are especially susceptible to accidental and potentially infectious needle strikes due to the careless handling or breaking of the cannula and disposing of the syringe after use. The resulting mini-accidents caused by an inadvertent needle strike typically require a blood test for such diseases as AIDS and Hepatitis. The corresponding cost and inefficiency of testing health care workers who have received an inadvertent needle strike result in considerable waste, which may be particularly damaging to a health care facility which is striving for economy.

In our copending patent application filed concurrently herewith and entitled "COLLAPSIBLE BLOOD COLLECTOR", a safety enhancing, relatively low-cost, collapsible needle cover is described which is associated with a double-ended hypodermic needle cannula and a collapsible blood collection tube holder within which a blood sample may be automatically drawn from a patient. The present invention is directed to a collapsible needle cover which is associated with a hypodermic needle cannula and a syringe cylinder from which a fluid medication, or the like, may be expelled to a patient.

SUMMARY OF THE INVENTION

In general terms, this invention relates to a safety enhancing, relatively low-cost, needle cover which is integrally bonded to and collapsible around a disposable, single use needle cannula. In a first embodiment of the invention, the combination cannula and collapsible needle cover is detachably connected to the distal bore of a hypodermic syringe. In a second embodiment, the combination cannula and collapsible needle cover is integrally connected to the distal bore of a syringe so as to form a one-piece, disposable syringe assembly.

The needle cover of the present invention comprises distally and proximally oriented pairs of needle cover segments, each of which segments being joined to an adjacent segment by means of an integral hinge around which said cover segments pivot. The needle cover is collapsible from an open, expanded configuration, at which the needle cannula is biased in an

armed state for administering an injection, to a closed, generally planar configuration, at which the needle cannula is biased in a shielded state, to be completely surrounded and isolated by the cover. A pair of oppositely disposed, rotatable motion transferring arms is connected to the needle cover so that a health care worker may manually and selectively move the cover between the open and closed configurations.

A locking catch is connected to one of the needle cover segments and is adapted to move into respective engagement with adjacent cover segments to either releasably retain the needle cover in the open configuration with the cannula in the armed state or permanently lock the needle cover in the closed configuration with the cannula in the shielded state. Accordingly, the needle cannula may be safely disposed of after use within its collapsible cover to avoid subjecting the health care worker to an accidental needle strike and the spread of a contagious, and possibly life threatening, disease.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows the collapsible needle cover according to a first embodiment of the invention detachably connected to the distal bore of a hypodermic syringe and moved to a closed, generally planar configuration for surrounding and shielding a disposable needle cannula;

FIG. 2 shows the collapsible needle cover of FIG. 1 in an open, generally expanded configuration to expose the needle cannula for the purpose of administering an injection of the fluid contents of the syringe;

FIGS. 3-5 illustrate the details for operating the needle cover of FIG. 1; and

FIGS. 6 and 7 show the collapsible needle cover according to a second embodiment of the invention integrally connected to the distal bore of a hypodermic syringe to form a one-piece, disposable syringe assembly.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The collapsible needle cover according to a first embodiment of the present invention is best described while referring to FIGs. 1-5 of the drawings, where FIGs. 1 and 2 show the needle cover 1 detachably connected to the distal bore of the hollow cylinder 3 of a conventional hypodermic syringe (shown in phantom and represented by the reference numeral 2). The needle cover 1 is preferably, but not necessarily, fabricated from a radiation grade polypropylene material. FIG. 1 shows the needle cover 1 in a closed, generally planar configuration so as to completely surround, shield, and isolate a needle cannula 4 and thereby prevent an accidental needle strike and the spread of a contagious, and possibly life threatening disease. FIG. 2 shows the needle cover 1 in an open, expanded configuration to expose the cannula 4 and thereby permit said cannula to either communicate with a source of fluid (so that the syringe 2 may be infused with a medication, vitamin, or the like) or penetrate the skin of a patient (so that an injection may be administered according to medically accepted

techniques). As will soon be described, the collapsible needle cover 1 and needle cannula 4 are integrally connected to one another so as to be attached to or removed from the syringe 2 as a one piece, combination cannula/cover.

Referring to concurrently to FIGs. 1 and 2, the needle cover 1 is shown comprising distally and proximally oriented pairs of needle cover segments 6-1 and 6-2. Each needle cover segment 6-1 and 6-2 is joined to its adjacent segment by means of a respective, integral hinge 7 around which the cover pivots when moving between the closed and open configurations of FIGs. 1 and 2. A narrow orifice 8 is established through the hinge 7 at the intersection of the distally oriented cover segments 6-1, so as to receive the distal end of needle cannula 4 therethrough when the needle cover 1 is moved to the open, expanded configuration of FIG. 2.

The proximally oriented pair of needle cover segments 6-2 are connected to a needle support 10 by means of integral hinges 9. A conventional luer lock fitting 12 projects proximally from the needle support 10. In the

assembled relationship of FIGs. 1 and 2, the luer lock fitting 12 of needle cover 1 is interconnected (i.e. rotated into engagement) with the distal bore of the syringe cylinder 3 whereby to detachably connect the needle cover 1 to the syringe 2. The needle support 10 is integrally connected (e.g. molded or thermally bonded) to the needle cannula 4 so as to support and retain the cannula in coaxial alignment with the luer lock fitting 12 and the cylinder 3 of syringe 2. Hence, the needle cover 1 and needle cannula 4 are packed and shipped to health care facilities as a single piece, combination cannula/cover. Moreover, and in the assembled relationship, the proximal end of cannula 4 communicates with the interior with the syringe cylinder 3 via the luer lock fitting 12, whereby the cylinder may be infused with fluid or fluid may be expelled from the cylinder (with the needle cover 1 in the open, expanded configuration of FIG. 2).

A pair of motion transferring arms 14 projects outwardly and in opposite directions from respective proximally oriented needle cover segments 6-2. As will be explained when referring to FIG. 4 the motion transferring arms 14 may be manually rotated towards one another, whereby to cause the needle cover segments

6-1 and 6-2 to pivot around their respective hinges 8 and 9 and thereby cause needle cover 1 to move from the closed, substantially planar configuration of FIG. 1, to the open, expanded configuration of FIG. 2, such that needle cannula 4 is biased in an armed state from a shielded state.

A locking catch 16 extends from one of the proximally oriented cover segments 6-2. A first notch 18 is formed in the other of the proximally oriented cover segments 6-2. A second notch 20 is formed in the distally oriented cover segment 6-1 which lies immediately above and is contiguous with the proximally oriented cover segment 6-2 from which locking catch 16 extends. As will also be explained while referring to FIGS. 4 and 5, the locking catch 16 performs a dual function. In a first case, locking catch 16 is rotated through notch 20 to automatically and releasibly retain needle cover 1 in the open, expanded configuration of FIGS. 2 and 4 and thereby permit the cylinder 3 of syringe 2 to be infused with fluid for the purpose of administering an injection. In a second case, locking catch 16 is rotated through notch 18 to automatically lock needle cover 1 in the closed, substantially planar configuration of FIGS. 1 and 5, whereby the needle

cannula 4 is surrounded, shielded, and isolated to permit the cannula to be safely handled and discarded after use while avoiding an accidental needle strike.

The operation of the collapsible needle cover 1 is now describe while referring to FIGs. 3,4, and 5 of the drawings. FIG. 3 shows the needle cover 1 immediately after its removal from a package in which said cover is transported to a health care facility. More particularly, a pre-sterilized needle cover 1 is packed in a substantially collapsed condition with the needle cover segments 6-1 and 6-2 thereof pivoted around their respective hinges 7 and 9 to the closed, generally planar configuration to surround needle cannula 4. However, to permit the cover 1 to be moved, by a health care worker, out of the collapsed condition, whereby needle cannula 4 may be biased in the armed state (of FIG. 4) from the shielded state (of FIG. 3) so that an injection may be administered, the locking catch 16 is located next to, but outside, the notch 18 in the adjacent proximally oriented cover segment 6-2. That is to say, the needle cover 1 is moved to but not locked in the closed, generally planar configuration.

The combination needle cover 1/needle cannula 4 is removed from its package with the cover in the collapsed configuration and the needle cannula 4 in the shielded state. The cover is then removably attached to the syringe 2 by rotating the luer lock fitting 12 of the cover into engagement with the distal bore of the syringe cylinder 3.

In FIG. 4, the needle cover 1 is moved out of the collapsed condition, so that needle cannula 4 can be biased in the armed state. More particularly, with the needle cover 1 attached to the cylinder 3 of syringe 2, the health care worker applies an axially and proximally directed force to each of the pair of motion transferring arms 14 (in the direction of the reference arrows 22 of FIG. 3). Accordingly, the arms 14 will rotate towards one another in a generally proximal direction, whereby to correspondingly cause needle cover segments 6-1 and 6-2 to pivot around their respective hinges 7 and 9 for movement to the open, expanded configuration of FIG. 4. During the relocation of needle cover 1 (in the direction of reference arrow 24), the locking catch 16, which extends from a proximally oriented cover segment 6-2 is advanced through the notch 20, whereby to be

automatically snapped into engagement with its adjacent, contiguously disposed and distally oriented cover segment 6-1 in which the notch 20 is formed to releasably and reliably retain needle cover 1 in the open, expanded configuration. Moreover, the distal end of needle cannula 4 extends through the opening 8 in the hinge 7 between adjacent distally oriented cover segments 6-1, so that cannula 4 is held in the armed state at which syringe cylinder 3 is infused with fluid for subsequent injection through the skin of a patient.

After an injection is administered, and referring now to FIG. 5 of the drawings, the needle cover 1 is again collapsed whereby cover segments 6-1 and 6-2 are returned to the closed, generally planar configuration and needle cannula 4 is biased in the shielded state. More particularly, the health care worker detaches the locking catch 16 from (i.e. rotates locking catch 16 out of engagement with) the distally oriented needle cover segment 6-1, such that the catch is moved out of notch 20. With his thumb and index finger, the health care worker then applies equal and opposite, laterally directed forces (in the direction of the reference arrows 26) to the proximally oriented needle cover segment 6-2 to cause the segments 6-1 and 6-2 to pivot

around their respective hinges 7 and 9 and thereby collapse needle cover 1 around needle cannula 4. The continued application of the laterally directed forces advances locking catch 16 through the notch 18 in the proximally oriented cover segment 6-2 in which said notch is formed.

Accordingly, locking catch 16 is automatically snapped into engagement with cover segment 6-2, whereby to permanently lock needle cover 1 in the closed, generally planar configuration with needle cannula 4 biased in the shielded state. Hence, the needle cover segments 6-1 and 6-2 surround, shield and isolate the cannula 4 so that the syringe 2 may be safely handled without subjecting the health care worker to an accidental needle strike and the spread contagious and possibly life-threatening disease. Since the locking catch 16 prevents the inadvertent return of the needle cover 1 to the open, expanded configuration (of FIG. 4), needle cover 1 may be detached from syringe cylinder 3. However, unlike many conventionally syringe assemblies, the needle cannula 4 need not be directly handled, cut, or otherwise destroyed after use, but may be conveniently and safely discarded in

the shielded state of FIG. 5 within the collapsed needle cover 1.

A collapsible needle cover 31 according to a second embodiment of the present invention is now described while referring to FIGs. 6 and 7 of the drawings. Like the needle cover 1 of FIGs. 1-5, the needle cover 31 of FIGs. 6 and 7 is integrally connected (e.g. molded or bonded) to a needle cannula 34. However, needle cover 31 is also integrally connected to the distal bore of a cylinder 33 from a syringe 32 so as to form a one-piece, disposable syringe assembly.

Needle cover 31 comprises distally and proximally oriented pairs of needle cover segments 36-1 and 36-2 which are hingedly interconnected with one another and adapted to pivot when cover 31 is moved between the closed and open configurations. That is, FIG. 6 shows the needle cover 36 in a closed, generally planar configuration with the needle cover segments 36-1 and 36-2 completely surrounding, shielding, and isolating the cannula 34 so as to prevent an accidental needle strike. FIG. 7 shows the needle cover 31 in the open, expanded configuration to expose the cannula 34 through an orifice 38 in the cover 31 and thereby permit the

fluid contents of syringe 33 to be injected through the skin of a patient.

A pair of force transferring arms 44 project outwardly and in opposite directions from respective proximally oriented needle cover segments 36-2. As previously disclosed when referring to FIGs. 4 and 5, axially and proximally directed forces may be manually applied to the motion transferring arms 44 (in the direction of the reference arrows 46 of FIG. 6) to cause said arms to rotate, whereby needle cover segments 36-1 and 36-2 are correspondingly pivoted around their respective hinges. Hence, the needle cover 31 is moved to the open, expanded configuration of FIG. 7 with needle cannula 34 biased in the armed state. The continued application of force to motion transferring arms 46 (in the direction of reference arrows 50) also causes a locking catch 48, which extends from a proximally oriented cover segment 36-2, to be advanced through a notch 52 and snapped into engagement with the adjacent and contiguously disposed distal cover segment 36-1 in which such notch is formed. Accordingly, the needle cover 31 is releasably retained in the open, expanded configuration of FIG. 7 so that an injection may be administered.

A description of the return of needle cover 31 to the closed, generally planar configuration of FIG. 6 with needle cannula 34 in the shielded state (suitable to permit the one-piece syringe 32 of the second embodiment to be safely discarded after use) is similar to that which was previously provided when referring to FIG. 5. Therefore, for purposes of brevity, this description will be omitted.

By virtue of the present invention, a reliable, safety enhancing needle cover is available which is integrally connected to a needle cannula and easily manipulated between open and closed configurations, whereby either an injection may be administered or the cannula may be completely surrounded, shielded, and isolated so as to be suitable for disposal after a single use without requiring the needle to be handled, cut or destroyed. Accordingly, a health care worker will not be subjected to the risk of an accidental needle strike and the spread of a contagious and life-threatening, disease.

It will be apparent that while the preferred embodiments of the invention have been shown and described various modifications may be made without departing from the true spirit and scope of the invention. Having thus set forth a preferred embodiment of the invention what is claimed is:

CLAIMS

1. For a syringe (2) having a cylinder (3) within which a fluid is to be received and a needle cannula (4) communicating fluidically with the interior of said cylinder, a needle cover (1) being collapsible from an open, expanded configuration, at which said cannula is exposed to contact a targeted tissue area, to a closed configuration, at which said cannula is shielded to avoid an accidental needle strike, said needle cover characterized by:

a plurality of segments (6-1, 6-2) pivotally connected to one another and a plurality of hinges (7) located respectively between successive cover segments, such that said cover is collapsible at said hinges from the open to the closed configuration;

first locking means (16, 20) locking said needle cover in the open configuration with said cannula projecting outwardly from said cover for making contact with the targeted tissue area; and

second locking means (16, 18) for locking said needle cover in the closed configuration with the segments of said cover surrounding and thereby shielding said needle cannula.

2. The needle cover (1) for the syringe (2) as recited in claim 1, wherein each of said hinges (7) is integrally connected between a respective pair of the segments (6-1, 6-2) of said needle cover.

3. The needle cover (1) for a syringe (2) as recited in claim 1, wherein said first locking means includes a locking catch (16) extending from one of said plurality of needle cover segments (6-2) for connection to a second of said plurality of segments (6-1) for retaining said needle cover in the open configuration with said needle cannula (4) projecting outwardly therefrom.

4. The needle cover (1) for a syringe (2) as recited in claim 3, further characterized by a notch (20) formed through the second of said plurality of needle cover segments (6-1) for receiving said locking catch (16) therewithin and thereby retaining said needle cover in the open configuration.

5. The needle cover (1) for a syringe (2) as recited in claim 1, wherein said second locking means includes a locking catch (16) extending from one of said plurality of needle cover segments (6-2) for connection to a second of said plurality of segments (6-2) for retaining said needle cover in the closed configuration with said needle cannula (4) surrounded and shielded.

6. The needle cover (1) for a syringe (2) as recited in claim 5, further characterized by a notch (18) formed through the second of said plurality of needle cover segments (6-2) for receiving said locking catch (16) therewithin and thereby retaining said needle cover in the closed configuration.

7. The needle cover (1) for a syringe (2) as recited in claim 1, wherein said first and second locking means include a locking catch (16) extending from one of said plurality of needle cover segments (6-2), a first notch (20) formed through a second of said needle cover segments (6-1), and another notch (18)

Claim 7 continued

formed through a third of said needle cover segments (6-2), said locking catch (16) received within said first notch (20) for connecting said locking catch to said second needle cover segment and thereby retaining said needle cover in the open configuration, or said locking catch (16) received within said other notch (18) for connecting said locking catch to said third needle cover segment and thereby retaining said needle cover in the closed configuration.

8. The needle cover (1) for a syringe (2) as recited in claim 1, wherein said cover is integrally connected to the cylinder (3) of said syringe to form a one piece, non-detachable syringe and needle cover assembly.

9. The needle cover (1) for a syringe (2) as recited in claim 1, wherein said cylinder (3), said needle cannula (4), and said needle cover (1) are integrally interconnected with and non-detachable from one another to form a one piece syringe assembly.

10. The needle cover (1) for a syringe (2) as recited in claim 1, further characterized by at least one motion transmitting arm (14) extending from said cover such that the application of an axial force to said arm causes the segments (6-1, 6-2) of said needle cover to pivot relative to one another and said needle cover to move between the open and closed configuration.

1/2

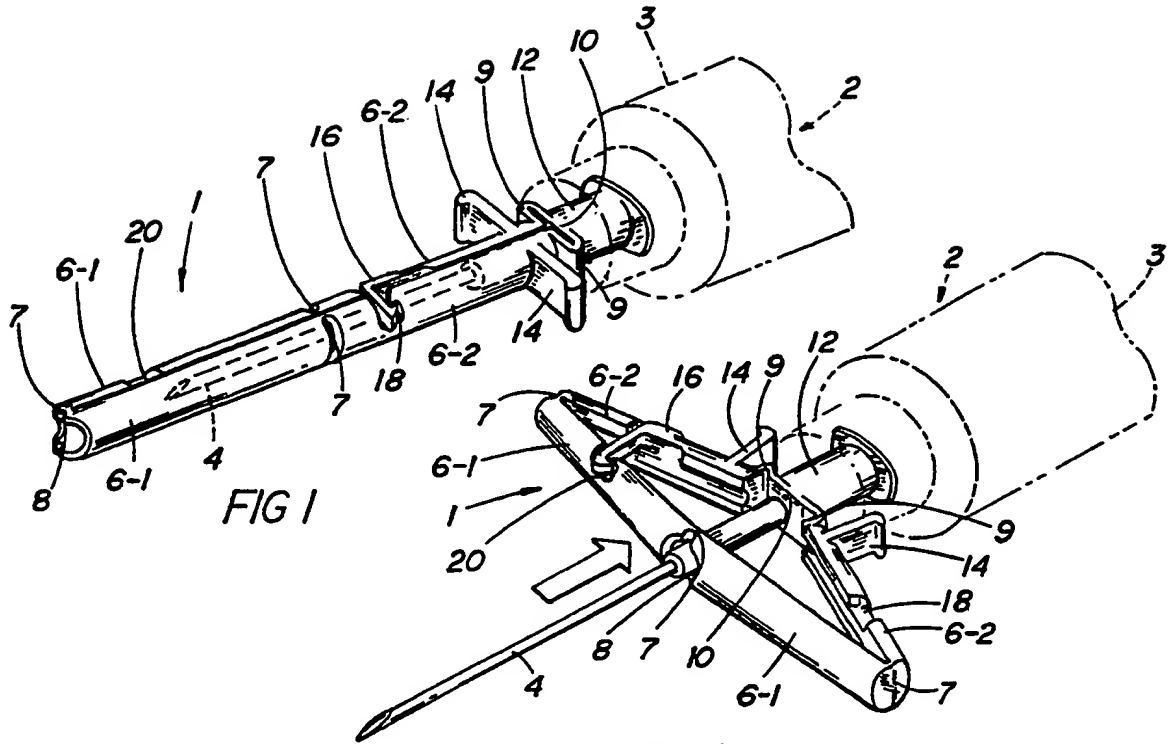


FIG 2

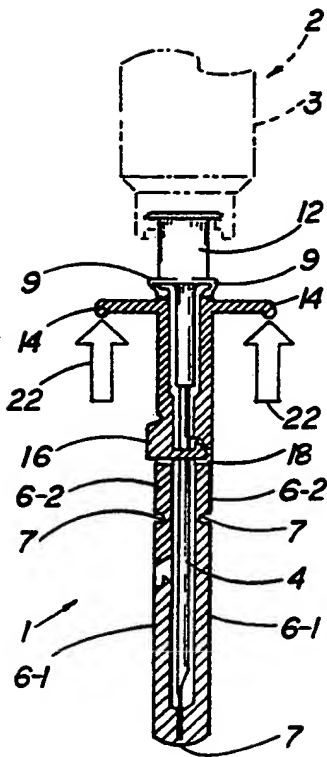


FIG 3

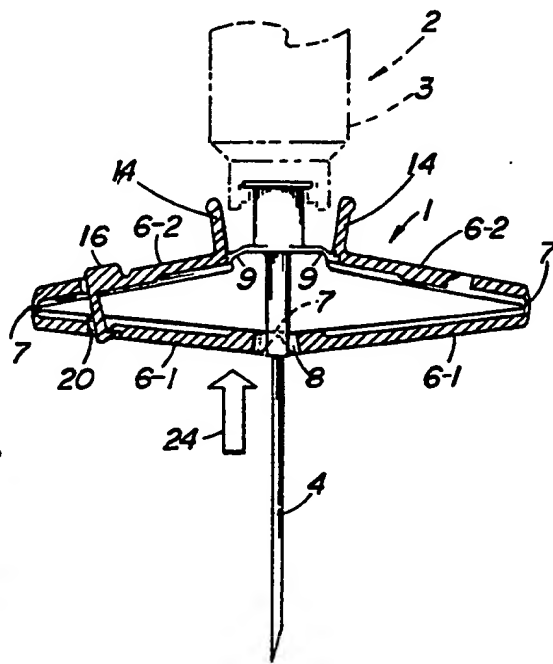


FIG 4

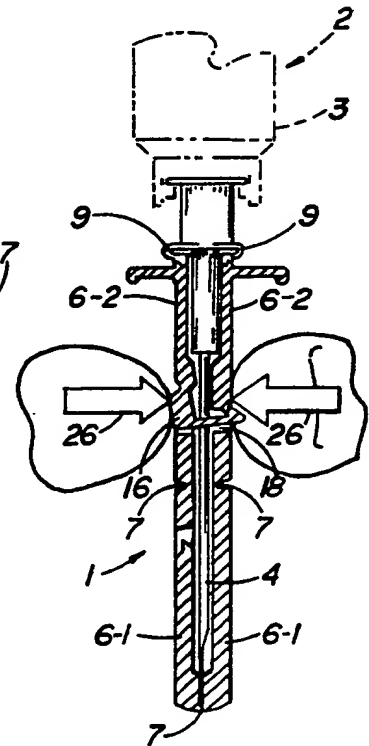


FIG 5

SUBSTITUTE SHEET

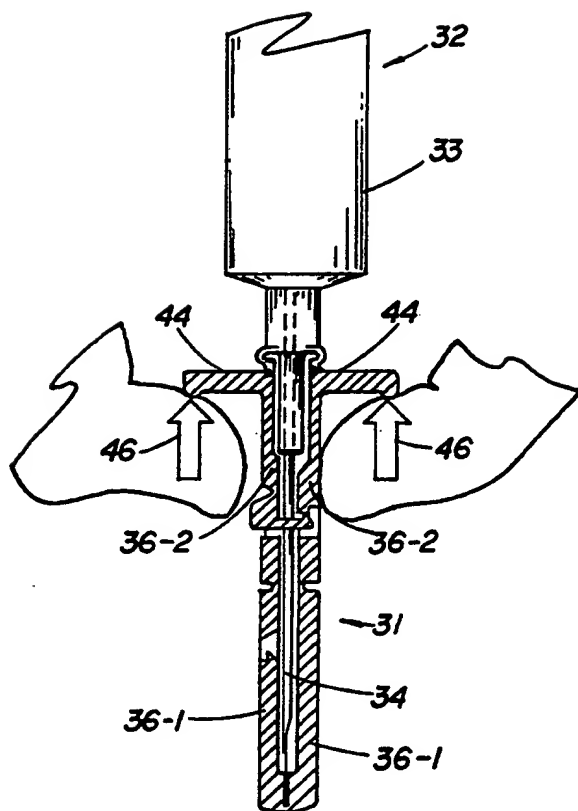


FIG 6

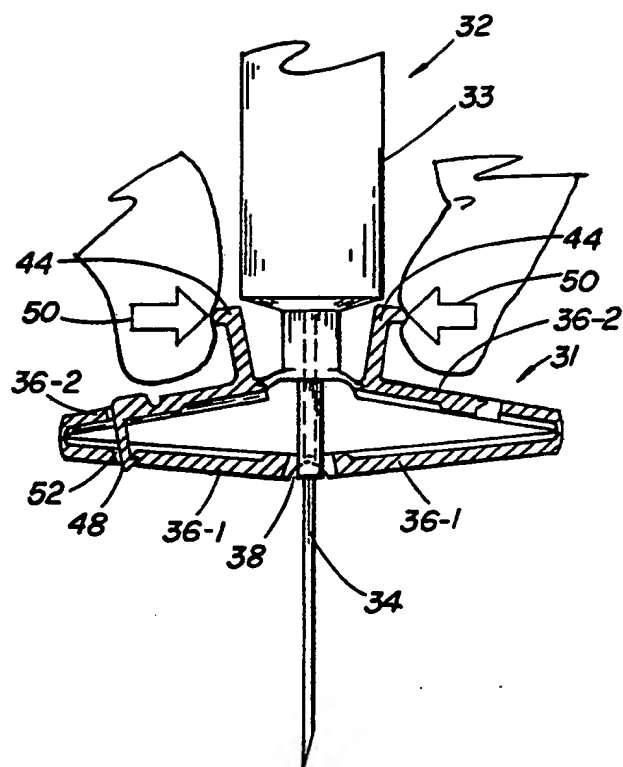


FIG 7

SUBSTITUTE SHEET

INTERNATIONAL SEARCH REPORT

International Application No. **PCT/US89/00739**

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶ According to International Patent Classification (IPC) or to both National Classification and IPC <div style="text-align: center; font-family: monospace; font-size: 1.2em;"> I C (4): A61M 5/32 US CL: 604/198 </div>																				
II. FIELDS SEARCHED <div style="text-align: center; font-size: 0.8em;">Minimum Documentation Searched ⁷</div> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%; padding: 5px;">Classification System</td> <td style="padding: 5px;">Classification Symbols</td> </tr> <tr> <td style="padding: 5px;"> <div style="font-family: monospace; font-size: 1.1em;"> U.S. 128/760-765 604/110, 111, 117, 162; 163, 192, 197, 198, 263 2006/365, 366 </div> </td> <td style="padding: 5px;"></td> </tr> </table> <div style="text-align: center; font-size: 0.8em;">Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸</div>			Classification System	Classification Symbols	<div style="font-family: monospace; font-size: 1.1em;"> U.S. 128/760-765 604/110, 111, 117, 162; 163, 192, 197, 198, 263 2006/365, 366 </div>															
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III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹ <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 10%; padding: 5px;">Category ⁹</th> <th style="width: 60%; padding: 5px;">Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²</th> <th style="width: 30%; padding: 5px;">Relevant to Claim No. ¹³</th> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">X,P</td> <td style="padding: 5px;">U.S.,A, 4,790,828, DOMBROWSKI ET AL, 13 December 1988, see entire document.</td> <td style="text-align: center; vertical-align: top; padding: 5px;">1,2,8-10</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">A</td> <td style="padding: 5px;">U.S.,A, 3,840,008, NOILES, 08 October 1974, see entire document.</td> <td style="text-align: center; vertical-align: top; padding: 5px;">1-10</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">A</td> <td style="padding: 5px;">U.S.,A. 4,139,009 ALVEREZ, 13 February 1979, see entire document.</td> <td style="text-align: center; vertical-align: top; padding: 5px;">1-10</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">A</td> <td style="padding: 5px;">U.S.,A. 4,725,267, VAILLAN COURT, 16 February 1988, see entire document.</td> <td style="text-align: center; vertical-align: top; padding: 5px;">1-10</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">X,P</td> <td style="padding: 5px;">U.S.,A. 4,735,618, HAGEN, 05 April 1988, see entire document.</td> <td style="text-align: center; vertical-align: top; padding: 5px;">1-10</td> </tr> </table>			Category ⁹	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³	X,P	U.S.,A, 4,790,828, DOMBROWSKI ET AL, 13 December 1988, see entire document.	1,2,8-10	A	U.S.,A, 3,840,008, NOILES, 08 October 1974, see entire document.	1-10	A	U.S.,A. 4,139,009 ALVEREZ, 13 February 1979, see entire document.	1-10	A	U.S.,A. 4,725,267, VAILLAN COURT, 16 February 1988, see entire document.	1-10	X,P	U.S.,A. 4,735,618, HAGEN, 05 April 1988, see entire document.	1-10
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A	U.S.,A. 4,725,267, VAILLAN COURT, 16 February 1988, see entire document.	1-10																		
X,P	U.S.,A. 4,735,618, HAGEN, 05 April 1988, see entire document.	1-10																		
<div style="font-size: 0.8em;"> ⁹ Special categories of cited documents: ¹⁰ "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. "&" document member of the same patent family </div>																				
IV. CERTIFICATION <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; padding: 5px;"> Date of the Actual Completion of the International Search <div style="text-align: center; font-family: monospace; font-size: 1.1em;">11 April 1989</div> </td> <td style="width: 50%; padding: 5px;"> Date of Mailing of this International Search Report <div style="text-align: center; font-family: monospace; font-size: 1.2em;">05 JUN 1989</div> </td> </tr> <tr> <td style="padding: 5px;"> International Searching Authority <div style="text-align: center; font-family: monospace; font-size: 1.1em;">ISA/US</div> </td> <td style="padding: 5px;"> Signature of Authorized Officer <div style="text-align: center;"> K. M. Reichle </div> </td> </tr> </table>			Date of the Actual Completion of the International Search <div style="text-align: center; font-family: monospace; font-size: 1.1em;">11 April 1989</div>	Date of Mailing of this International Search Report <div style="text-align: center; font-family: monospace; font-size: 1.2em;">05 JUN 1989</div>	International Searching Authority <div style="text-align: center; font-family: monospace; font-size: 1.1em;">ISA/US</div>	Signature of Authorized Officer <div style="text-align: center;"> K. M. Reichle </div>														
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